LETTERS TO THE EDITOR.

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Percussion Caps for Shooting in Schools.

THE extraordinary explosive power of fulminate of mercury is known to all chemists, but it is not generally known that the explosion of a percussion cap on a gun will cause a current of air sufficient to extinguish a candle at a distance of ten or fifteen feet. The distance, of course, varies with the length and bore of the gun, and with the nature and the size of the candle. The gun must be pointed at the lower part of the wick, and in order to blow out the candle the aim at this distance requires to be nearly as accurate as would be required to make a centre with a rifle at a hundred yards. In a speech to the Primrose League on May 9, Lord Salisbury mentioned the expediency of every man having the chance to learn to handle a rifle within reach of his own cottage. By beginning with percussion caps children might be taught to handle a gun at such an early age, that, in case of invasion of this country, boys of fourteen might be able to act as soldiers, as they are said to be doing amongst the Boers at the present time. The objections to training children to handle a rifle are, first of all, the danger of the child shooting either itself or some one else; and secondly, the expense. But the inclination of children to play soldiers might readily be utilised by teaching them to handle first of all a toy gun, and then to practice shooting at a candle with caps. For those who shoot best with caps, the practice with a saloon rifle might be held out as a reward. One single-barrelled old muzzle-loading gun would suffice for many children, and as 240 caps cost a shilling, the expense of providing a gun and material for practice would be very small. LAUDER BRUNTON.

Escape of Gases from Planetary Atmospheres.

IN NATURE of March 29 (p. 515), Dr. Stoney, in referring to a paper by the writer in the January number of the *Astrophysical Journal*, raises the question as to the correctness of the use of Maxwell's distribution of velocities in computing the escape of gases from the earth's atmosphere. He maintains that this distribution does not hold at its attenuated limits. In my paper I have not taken conditions which may exist there, but boundary conditions, which are much more favourable to the escape of the molecules of a gas, and certainly compatible with the kinetic theory, if we are to accept such a theory at all.

Of the four conditions discussed in my paper, I will only refer to the third, the data for which are based on direct observation, namely, $-66°$ C. at a height of 20 kilometres (the mean of several ascensions really giving $-65°$ C. to $-70°$ C. for a height of only 16 kilometres). The pressure is calculated from the usual exponential formula, which agrees closely with observations to this height. At these temperatures and pressures there can be no question as to the validity of the kinetic theory.

Let us assume now that the atmosphere abruptly terminates at this height, and at this temperature the loss would certainly be greater (in fact, very much greater) than under the actual conditions, where the temperature and pressure are much lower. It should also be noticed that in my tables I have assumed the atmosphere to be entirely made up of one gas—for example, helium or hydrogen. Even then only $26{\cdot}73 \times 10^{-23}$ c.c. of helium would escape in 10^7 years. Hence the assumption that helium is now escaping from our atmosphere is without foundation. In the case of a hydrogen atmosphere only 0·54 c.c. will escape in one year. If the total amount of air in the atmosphere be taken approximately at 10^{24} c.c., and if the actual density and temperature at the outer limits of the atmosphere be also considered, it will be evident how baseless the supposition is that either helium or hydrogen is escaping. It should be further noted that Maxwell's distribution of velocities from zero to infinity is the only one giving a sufficient velocity for any escape at all, Clausius' theory not being adequate.

It was the assumption that helium is escaping from the atmosphere—since it had not been detected—that first led me to verify it on the kinetic theory of Maxwell. The discovery, by Ramsay, of helium as a constituent of our atmosphere only tends to confirm the results of my calculations of the impossibility of its escape. S. R. COOK.

Physical Laboratory, University of Nebraska, April 26.

Racket Feathers.

YOUR able reviewer of Meyer and Wiglesworth's "Birds of Celebes" (NATURE, April 26), criticising the arguments used to account for the formation of the racket tail feathers of the parrot, *Prioniturus* (as an inherited effect of mechanical attrition on objects against which the tail is liable to be brushed—boughs, walls of nesting-hole, &c.), asks the pertinent question, why so few exposed feathers, such "as the external rectrices and remiges of all birds, and specially the lengthened feathers of wedge-shaped tails (*Dicrurus*) are neither bare nor racket-shaped nor incipiently so." The insignificant length of the outer rectrices of *Dicrurus* perhaps safeguards them; when these feathers are longer, as in the closely-allied *Bhringa* and *Dissemurus*, they *are* racket-shaped. As to the remiges and rectrices of birds generally, one feather overlies and to a great extent protects the next; but still, the outer webs *are* always very much narrowed in the outermost and most exposed feathers, less narrowed in the next, and so on till in the middle of the wing and tail (where they are well protected on both sides) they are not narrowed at all. But, while normal wing and tail feathers are exposed to attrition on one web only, long feathers standing well out from the rest are liable to have the web frayed on both sides of the shaft as far as they project beyond the other feathers, and to some extent where they rest upon the other feathers through friction against the latter. It is assumed that at some period earlier in the history of the race these elongated feathers were of the usual simple shape, but they are now known to issue from the follicles displaying peculiarities which are often much the same as those obtained by scraping an ordinary feather with a knife—namely, if the shaft is stiff and not very long, a small terminal spatule is formed (as in *Prioniturus*, *Parotia*); if the shaft is long and weak, a large spatule (as in *Tanysiptera*, *Loddigesia*). A difficulty, perhaps, to the acceptance of the theory is its apparent consequence—that epidermal (in a sense, dead) structures, like feathers, possess the power of transmitting mutilations to posterity. For my own part, I think that the modification of shape of the feathers is communicated to the sensitive tissues (much in the same way as the shape of a stick placed in the hand of a blind man is comprehended by him after touching other things with it), and that a corresponding physiological adjustment is made and gradually inherited. The result is probably not an exact recapitulation of the mutilation, but it sometimes appears to be very nearly so.

L. W. WIGLESWORTH.

Castlethorpe, Stony Stratford, April 30.

MR. WIGLESWORTH in the above note hardly does more than recapitulate the (?) arguments advanced in the "Birds of Celebes." He does not offer any explanation of the crucial difficulties indicated in the review; why "mechanical attrition on objects," or by the wind, is effective only in so few cases throughout the class *Aves* when so many species are subject to the necessary conditions; why, for instance, the species of *Palaeornis* (belonging to the same sub-family as *Prioniturus*), or those of the genus *Irissor*, do not conform to the "law"; and why one sex of a species may have "sabre wings," or spatulate ornaments in various situations, and the other sex not.

The question may also be asked *apropos* of Mr. Wigleworth's statement above, why in *Paradisea rubra* the *long* and *weak*-shafted tail feathers have the *small* spatule (which eventually vanishes) instead of a *large* one, if the knife-scraping analogy holds good?

The reasons for the *exceptions* to the author's rule is what chiefly demands an explanation, in the opinion of

THE REVIEWER.

THE APPROACHING TOTAL ECLIPSE OF THE SUN.

THE approaching total solar eclipse, on the 28th of the present month, promises to contribute some valuable additions to our scientific knowledge of the centre of our system, inasmuch that the track of the moon's shadow on the earth's surface passes, to an unusual extent, through regions which are easily accessible. Entering the North American continent near New Orleans, in Louisiana, the central line of eclipse traverses the States of Mississippi, Alabama, Georgia and Carolina,

passing on to the Atlantic from the shore of Virginia, near Norfolk. The track is thus crossed by many of the numerous railway systems of the Southern States, exceptional facilities being thereby offered to observers with large instruments. Information supplied by the U.S. Weather Bureau indicates that stations in Alabama and Georgia are most likely to be favoured with an unclouded sky; hence the expeditions from the chief American observatories will go there. Congress has voted 5000 dollars to the Naval Observatory, and 4000 dollars to the Smithsonian Institution, for the necessary equipment. The Naval Observatory staff will organise two expeditions, one going to North Carolina, the other to Georgia, so that the stations will be some 200 miles apart, and will furnish valuable evidence as to the changes to which the solar surroundings are subject.

The Smithsonian Institution will be represented by Prof. S. P. Langley, and the Princeton Observatory by Prof. Young, who will make a redetermination of the wave-length of the green corona line. Prof. Stone will conduct a party from the University of Pennsylvania, and although details are as yet unknown here, it is expected that expeditions from the Yerkes (Profs. Hale, Barnard and Frost) and Lick (Prof. Campbell) Observatories will endeavour to obtain complete spectroscopic records of the various stages of the eclipse. The latter will again use the 40-foot coronograph, giving a 4-inch disc on plates 14×17 inches. Prof. Pickering, of the Harvard College Observatory, proposes to make a systematic search for an intra-Mercurial planet, and will probably occupy a station in Alabama.

By the kindness of Prof. Young, the Rev. J. M. Bacon has been enabled to organise an expedition to the States, and his observations will be made in the neighbourhood of Wadesborough, near the boundary between North and South Carolina. The party will consist of the Rev. J. M. Bacon, Miss Bacon, and Mr. and Mrs. Maskelyne. The two latter observers will expose a telescopic kinematograph on the corona during totality, and also an ordinary kinematograph on the landscape during and after totality, in the hope of recording the sweep of the moon's shadow. The Rev. J. M. Bacon, using a telescopic camera, will photograph the corona at definite times with respect to mid-totality, for determining the positions of sun and moon, and will expose a long film, continuously driven, to the zenith before, during and after totality, for recording the relative brightness of the sky during and without eclipse. By means of a kite, he will also compare the temperature of the air at an altitude of several hundred feet and at ground-level. Miss Bacon will attempt to photograph the outer corona and extensions, and also a series of landscape photographs showing the gradual diminution of illumination. Special attention will also be devoted to the "shadow bands," and to making standard photographic comparisons of the light of the corona with that of the full moon.

Prof. Burckhalter, of the Charbo Observatory, will photograph the corona by means of a camera provided with revolving screens, so adjusted as to give varying exposures for the different regions.

As the eclipse will occur at the American stations at times from 1h. 30m. to 1h. 50m., we in England will be able to hear of the results obtained there before the observers in Spain have commenced operations.

After leaving the American coast, the moon's shadow crosses the Atlantic in a westerly direction, and reaches the coast of Portugal, near Ovar, about 4.0 p.m. Thence it rapidly passes across the peninsula, leaving the mainland some little distance south of Alicante, and crossing the Mediterranean to Algiers. Most of the European expeditions will have stations along this line, chiefly at Ovar, Santa Pola and Algiers. Taking the stations in the order suggested by the progress of the eclipse, the distribution of the various parties and their plan of operations will be as follows:—

Ovar.—At this place, some twenty miles south of Oporto, and five miles from the coast, will be stationed one of the three official expeditions sent out by the British Government, the observers being the Astronomer Royal and Mr. Dyson, his chief assistant. The former has arranged to take large scale photographs of the corona with the 9-inch object-glass of the Thomson photoheliograph at Greenwich, the primary image being enlarged by a *concave* secondary magnifier to a scale of about 4 inches to the sun's diameter, on plates 15 × 15 inches; and also photographs with the double camera used in previous eclipses, having a 4-inch rapid rectilinear lens of 33 inches focus, and another of 13 inches focus, for recording the extensions of the coronal streamers.

Mr. Dyson's programme is purely spectroscopic. He will have two slit spectroscopes belonging to Captain Hills, and will endeavour to obtain photographs of the spectrum of the "flash" and of the corona.

Prof. Müller, of Potsdam, will from this station determine the albedo of Mercury from direct photometric comparisons with Venus, which will then be near its greatest brilliancy.

Santa Pola.—The second British official expedition will be stationed here, some distance south of the town of Alicante, on the east coast of Spain. The party will be under the direction of Sir Norman Lockyer, who will be primarily assisted by Mr. A. Fowler, Dr. W. J. S. Lockyer and Mr. H. Payn. On their arrival at Gibraltar, they will be taken on board H.M.S. *Theseus*, of the Mediterranean squadron, which will then convey them to their destination. As at Viziadrug in 1898, and Norway in 1896, volunteers will be selected from the ship's company, and parties detailed out for every character of observation it is possible to make during a total solar eclipse; and in the interval between their landing and the final day, besides the erecting and adjusting of the instruments, the principal observers will have their time fully occupied in giving lectures, practical demonstrations, and rehearsals to the host of volunteers who will undoubtedly offer themselves.

Sir Norman Lockyer will make visual observations with a 4-inch Cooke photo-visual telescope equatorially mounted, and will give the signals for the whole of the remaining human and mechanical machinery to be set in motion. The following are the chief sections of the observers:—

20-foot Prismatic Camera.—This will be manipulated by Mr. Fowler, and consists of a Cooke photo-visual triplet lens, of 6 inches aperture and 20 feet 3 inches focal length. Outside this will be placed the objective prism, of 9 inches aperture and 45° angle, which was used at Viziadrug in 1898. The instrument will be fixed horizontally, and fed with light from a 12-inch siderostat. It is proposed to obtain instantaneous photographs of the chromospheric spectrum at both internal contacts, and long-exposure photographs of corona spectrum during totality. It is hoped that the greatly increased dispersion given by this instrument will increase the contrast between the *line* and *continuous* spectra of the corona, and so render more accurate measurements of wave-length possible. The plates used will be 15 × 2½ inches.

6-inch Prismatic Camera.—This is the same instrument which was used with success by Mr. Fowler in 1898, and will be under the charge of Dr. Lockyer. It consists of a 6-inch object-glass by Henry, of 7 ft. 6 in. focus, outside which are adjusted two objective prisms, each of 6 inches aperture and 45° angle. The programme with this instrument is similar to that of the 20-foot.

Coronographs.—Several coronographs of varying power are being taken, the largest being under the charge of Mr. Howard Payn, a gentleman who has generously volunteered his services for the expedition. This instru-

ment has a Cooke photo-visual lens of 4 inches aperture and 16 feet focal length, the primary image being used on plates 12 × 12 inches.

In addition, the De la Rue coronograph (4⅝ inches aperture and 72 inches focal length), Graham coronograph (3 inches aperture, 21 inches focal length), and Dallmeyer coronograph (6-inch aperture rapid rectilinear, 48 inches focal length) will be used. Parties of the volunteers will be engaged in one or other of the following observations :—

Disc drawings of corona ...	about 19	volunteers.
Observations of ring spectra ...	,, 5	,,
Observations with pocket slit spectroscopes...	,, 4	,,
Observations of shadow bands...	,, 6	,,
Observations of stars and other celestial objects visible during totality	,, 20	,,
Shadow phenomena, both atmospheric and terrestrial ...	,, 6	,,
Colours of landscape, &c. ...	,, 12	,,
Meteorology, temperature, pressure, &c.	,, 15	,,
Photographs of landscape ...	,, 5	,,
Natural history effects on men and animals	,, 3	,,

In addition to these instruments, several of the observers will obtain photographs of the eclipse spectra by means of diffraction gratings and prisms fixed in front of their own small cameras. Those with gratings are likely to be specially useful, as the dispersion is sufficiently great to render it possible for the bright line spectra to show up from the continuous spectrum, and there is the further advantage of the large field given by an ordinary rectilinear, so that the spectrum of the streamers may also be obtained.

Prof. Copeland, Astronomer Royal of Scotland, will also occupy a station at Santa Pola, using a telescope of 40 feet focus.

The British Astronomical Association and the French Astronomical Society will each send parties to both Alicante and Algiers. As, however, the former place is so well occupied by Sir Norman Lockyer's party, the third official party from the British Government will occupy a station at Algiers, and will consist of Prof. Turner, Mr. Newall, Mr. Evershed and Mr. Wesley.

Prof. Turner will photograph the corona with one of the double cameras used in previous eclipses, one of which is arranged to polarise the coronal light before it reaches the photographic plate, and thereby determine the extent to which this light is initially polarised. In addition, he also hopes to repeat his work of 1893 and 1898 for determining photometrically the relative brightness of the corona at varying distances from the limb.

Mr. Newall will have three instruments under his charge, viz. :—(1) A four-prism slit spectrograph for obtaining the spectrum of the "flash," and of the corona. In the latter he hopes to obtain material for showing the difference, if any, between the spectrum of the coronal rays and the other portions. (2) An objective grating camera for photographing the spectrum of the corona in monochromatic light. (3) A polariscopic camera for photographing the corona, special attention being devoted to the study of any differences between the darker and brighter rifts.

Mr. Wesley, the assistant secretary of the Royal Astronomical Society, has for many years critically studied the minute structure of the corona, he being the draughtsman who has engraved the reproductions of many of the corona photographs of past eclipses for publication, but has not hitherto had an opportunity of studying it from nature. By the kindness of M. Trépied, the Director of the French Government Observatory at Algiers, Mr. Wesley will be enabled to examine the corona with the powerful "equatorial coudé" (about 8 inches aperture).

Mr. Evershed will not be stationed at Algiers itself, but intends to observe from a place near the limiting line of totality, about twenty miles south of Algiers, so that he may photograph the "flash" spectrum with somewhat longer exposure than near the central line.

Mr. and Mrs. Maunder will repeat at Algiers their programme so successfully carried out at Buxar, India, in 1898, but with larger apparatus. This will include short exposure photographs of the inner corona, and others with long exposure for extensions and streamers.

Mr. and Mrs. Crommelin will go to Algiers, and take photographs of the corona and of the shadow as projected on the atmosphere.

It is also stated that Mr. Percival Lowell, of Arizona, and Prof. Todd, of Amherst College Observatory, U.S.A., will occupy stations near Tripoli, in North Africa. It is to be hoped that favourable weather will enable the latter astronomer to successfully use his electrical control, by means of which he has arranged that a great number of photographic cameras shall be automatically exposed for varying times, all of which are operated from one revolving drum with delicately fitted electrical contacts.

The eclipse occurs at the European stations about 4.0 p.m. Greenwich time, so that it may be possible to communicate the results of the various expeditions to the evening papers of the same day.

Mention should be made of the generous arrangements which have been made by the authorities of all the Governments concerned, whereby the usual customs tariff and examination will be dispensed with, provided the observer is furnished with a certificate showing that his baggage is really for eclipse observation. The railway companies in Spain have also consented to convey passengers at half the usual fares.

CHARLES P. BUTLER.

THE ROYAL SOCIETY SELECTED CANDIDATES.

FIFTEEN candidates were selected by the Council of the Royal Society on Thursday last for election into the Society. The following are the names and qualifications of the new Fellows :—

GEORGE JAMES BURCH,

M.A. (Oxon). Lecturer at the University Extension College, Reading. Author of the following papers :—(1) "Experiments on Flame" (NATURE, 1885-86) ; (2) "A Perspective Microscope" (*Proc. Roy. Soc.*, vol. xiii.) ; (3) "Researches on the Capillary Electrometer" (*Proc. Roy. Soc.*, vol. xlviii., *ibid.*, vol. lix., *Phil. Trans.*, vol. clxxxiii(A)., *The Electrician*, July, 1896). "On a Method of drawing Hyperbolas" (*Phil. Mag.*, Jan., 1896). Also joint author of the following papers :—(1) "Dissociation of Amine Vapours" (with Mr. J. E. Marsh) (*Journ. Chem. Soc.*, 1889) ; (2) "E.M.F. of certain cells containing Nitric Acid" (with Mr. V. H. Veley) (*Phil. Trans.*, vol. clxxxii(A). ; (3) "Effect of Injury in Muscle" (with Prof. Burdon-Sanderson) (*Proc. Physiol. Soc.*, 1893) ; (4) "Action of Concentrated Acids on Metals in contact" (with Mr. S. W. Dodgson) (*Proc. Chem. Soc.*, 1894) ; (5) "D'Arsonval Physical Theory" (with Mr. L. E. Hill) (*Journ. Physiol.*, 1894) ; (6) "The Electromotive Properties of *Malapterurus electricus*" (with Prof. Gotch) (*Phil. Trans.*, 1896).

Supplementary Certificate.

Author of the following scientific papers in addition to those stated in the first certificate :—"On Prof. Hermann's Theory of the Capillary Electrometer" (*Proc. Roy. Soc.*, vol. lx., p. 328) ; "The Tangent Lens-gauge" (*Phil. Mag.*, 1897, p. 256) ; "An Inductor-Alternator for Physiological Experiments" (*Journ. of Physiology*, vol. xxi., 1897 ; "An Account of Certain Phenomena of Colour Vision with Intermittent Light" (*ibid.*) ; "Artificial Colour Blindness, with an Examination of the Colour-Sensations of 109 Persons" (*Phil. Trans.*, vol. clxli., 1899) ; joint author with Prof. Gotch, F.R.S., of the following scientific papers :—"The Electrical Response of